FORM PTO-1390 (REV. 11-2000) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER: H55-054 US

U S APPLICATION NO. (If known, see 37 CFR 1.5): 10/069093

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/AT00/00186	07 July 2000	09 July 1999

TITLE OF INVENTION: INJECTION MOLDING METHOD

APPLICANT(S) FOR DO/EO/US: Georg STEINBICHLER and Peter POKORNY

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [x] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [x] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [x] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [x] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [x] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [x] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [x] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [x] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [x] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [x] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [x] Other items or information:
    1 Sheet of Drawing, Fig. 1
    Petition to Revive - Unintentional
    Check - Petition Fee $1240.00
    Copy of Front Pg. of WO 01/ 03906 A1

U.S. APPLICATION NO (if known, see 37 CFR 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/069093	PCT/ES00/00085	J453-009 US

21. ☒ The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1000.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$860.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$	
Total claims	4 - 20 =	0	x **$18.00**	$ 0	
Independent claims	1 - 3 =	0	x **$80.00**	$ 0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$270.00**	$ 0	
TOTAL OF ABOVE CALCULATIONS =				$ 890.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +				$	
SUBTOTAL =				$ 890.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$	
TOTAL NATIONAL FEE =				$ 890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00	
TOTAL FEES ENCLOSED =				$ 930.00	
04/25/2002 MMBUYEN 00000118 141431 10063052 01 FC:154 130.00 CH 02 FC:15E 130.00 CH				**Amount to be refunded:**	$
				charged:	$

a. ☒ A check in the amount of $ 930.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-1431 . A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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28,643
REGISTRATION NUMBER

Patent
Atty. Docket: H55-054 US
VIA EXPRESS MAIL
Label No.: EV 063136319 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Georg STEINBICHLER, et al
Serial No.	:	N/A
Filing Date	:	Concurrently Herewith
Intl. Appln. No.	:	PCT/AT00/00186
Intl. Filing Date	:	July 7, 2000
For	:	INJECTION MOLDING METHOD

Commissioner for Patents
Washington, D.C. 20231
Attention: Box PCT

PRELIMINARY AMENDMENT

Sir:

Prior to examination, kindly amend the above-identified application, as follows:

IN THE CLAIMS:

Cancel claims 3 and 4, and substitute therefor, the following claims 5 and 6:

--5. A method according to claim 1, characterized in that the volume of the antechamber (1) at the opening of the shut-off means (2) is at least twice as great as the volume which is downstream of the shut-off means (2) and which includes the mold cavity (3).

6. A method according to claim 1, characterized in that the volume of the antechamber (1) is kept constant during the injection operation so that the total pressure in the mold cavity (3) is produced by expansion of the plastic material which initially fills only the antechamber (1). –

REMARKS

Claims 1, 2, 5 and 6 are in the application and presented for consideration.

By this amendment, applicants have deleted reference to multiple dependent claims. No new matter has been added.

Entry of the amendment is, therefore, respectfully requested.

Respectfully submitted,

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Dated: 1/30/02

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Injection-molding method

The invention relates to an injection-molding method in which plastic material under pressure is injected from an antechamber which can be shut off, into a mould cavity after opening of a shut-off means, and fills the mould cavity under pressure.

The operation of injecting the plastic material is usually effected by means of the screw which serves to plasticise the plastic material and which acts as a piston in the injection operation. There have however also been many proposals for passing the plasticised plastic material into a separate antechamber from which it is expelled by a piston which is independent of the plasticising screw.

Particularly in the production of small and thin-walled components, it is essential for the injection operation to be terminated rapidly as otherwise partial hardening of the plastic material already occurs in the cooled mould, during the injection procedure. In order to achieve high injection speeds, hitherto the advance speed of the screw or a separate injection piston which is possibly provided has been increased more and more. The invention is based on the thought that further development along those lines is not meaningful as, at high screw advance speeds, the molten material in the antechamber is primarily compacted, whereas that achieves little in terms of filling the mould cavity.

Therefore the object of the invention is to rapidly fill the mould cavity, particularly when injection-molding thin and small moldings, in which respect the speed of the injection piston is to play no part or only a subordinate part.

In accordance with the invention that is achieved in that the volume of the antechamber and the pressure prevailing therein, at the opening of the shut-off means, are of values, at the existence of which at least half of the pressure achieved in the mould cavity in the method occurs even if the volume of the antechamber is kept constant during the injection operation.

Insofar as hitherto a pressure which is comparable to the pressure in the mould interior has already been built up upstream of the shut-off means, prior to opening of the shut-off means, the only result of that was that the mould was initially partially filled by expansion of the plastic material in the antechamber until after some delay the action of the screw advance movement came into effect. In contrast, the invention is based on the notion that the entire mould cavity is filled merely by expansion of the supply of plastic material which has accumulated in the antechamber and which is under pressure. If in that respect a movement of the screw or other injection piston takes place intentionally or unintentionally, that only results in a modification of the adiabatic expansion method which in itself governs the filling of the mould. In practical terms that means that the pressure in the antechamber, which conventionally does not exceed 800 bars, is typically increased to over 1500 bars when carrying the invention into effect, and in particular that the volume of the antechamber is not reduced to a very substantial extent, as is usual, in the injection operation, but is entirely or predominantly maintained.

Details of the invention are described hereinafter with reference to the drawing showing a view in diagrammatic cross-section of an apparatus which is conventional in itself, for carrying the method into effect.

The method according to the invention can be carried into effect on any conventional injection-molding apparatus insofar as the feed flow to the mould cavity is controllable by a shut-off means. Therefore only the parts of an injection-molding apparatus which are essential to the method of the invention are described and illustrated here.

In the illustrated apparatus thermoplastic material is plasticised in the cylinder 8 by a screw 5 and passes into the antechamber 1. The antechamber extends through the bores 13 almost to the mould 7. Its front opening 14 is closable towards the mould 7 by means of a shut-off means 2, whereas a back-flow of the plastic material out of the antechamber 1 is prevented by a back-flow closure means 6 at the tip of the screw 5.

An essential functional part of the shut-off means 2 is in per se known manner a closure needle 9 which, under the pressure of the plastic material in the antechamber 1, has a tendency to move towards the right in the drawing. The

needle 9 is acted upon in the closure direction by a lever 11 which is pivotable about the pin 10 and which is subjected to the action of a controllable hydraulic unit 12.

It is essential for the invention that a substantially higher pressure is built up in the plastic material disposed in front of the shut-off means 2, than was hitherto usual, and that filling of the mould cavity 3 and the gate region 4 in front thereof, is effected by expansion of the plastic material in the antechamber 1. That does not exclude a movement of the screw 5 for increasing or reducing the pressure in the mould cavity 3 also being effected, to influence the pressure pattern in the mould cavity 3, after opening of the shut-off means 2. Opening of the shut-off means 2 can also be effected in a controlled manner in order to modify the pressure pattern in the mould cavity 3 which is determined primarily by the adiabatic relief of pressure of the plastic material in the antechamber 1.

In order to be able to suitably determine pressure and volume in the antechamber 1 for a given mould cavity 3, desirably firstly a volume which substantially exceeds the volume of the mould cavity 3 is selected for the antechamber 1. Then the desired pressure in the mould cavity 3 is selected. The pressure in the antechamber 1 which leads to that result can be ascertained in a simple series of tests. With knowledge of the state equation of the plastic material used, it is also readily possible to calculate that pressure. This will be subsequently demonstrated by means of an embodiment.

Example:

Material used: Polystyrene 143 E

Density at ambient temperature: 1.047 g/cm^3

Volume of the antechamber 1 in front of the shut-off means 2: 45.6 cm^3

Volume behind the shut-off means 2: 1.37 cm^3, of which 1 cm^3 actual mould cavity 3

The plastic material is under a pressure of 2000 bars, and its temperature is around 30° above the desired operating temperature of 220°C.

The shut-off means 2 is now opened, whereby the plastic material expands to the entire available volume, that is to say into the region 4 of the gate and into the mould cavity 3. Due to that adiabatic expansion, cooling by 30°C takes place and there is a pressure drop to the desired final range of 500 bars. That pressure is

generally easily sufficient for production of the desired product, but it can be increased by displacement of the screw 5, subsequently to opening of the shut-off means 2, or reduced (by displacement towards the left in the drawing).

It has been found that the mass enclosed in the antechamber 1 may differ from the theoretical value due to differences in the function of the back-flow closure means. This problem can be overcome by monitoring the pressure in the antechamber 1 as a function of screw position. If, for instance, the mass of plastic material in the antechamber is smaller than the ideal value, a certain pressure will be reached at a more forward position of the screw than in the ideal case. In such a case, the target value of the pressure is increased following a recalculation using the pVT diagram of the material in question.

It has also been found that the quality of the finished product is more uniform if there is a certain delay (preferably of one or two seconds) between the reaching of maximum pressure inside of the antechamber 1 and the opening of the shut-off means 2.

CLAIMS

1. An injection-molding method in which plastic material under pressure is injected from an antechamber (1) which can be shut off, into a mould cavity (3) after opening of a shut-off means (2), and fills the mould cavity under pressure, characterised in that the volume of the antechamber (1) and the pressure prevailing therein, at the opening of the shut-off means (2), are of values, at the existence of which at least half of the pressure achieved in the mould cavity (3) in the method occurs even if the volume of the antechamber (1) is kept constant during the injection operation.

2. A method according to claim 1 characterised in that the pressure in the antechamber (1) at the opening of the shut-off means (2) is over 1000 bars and preferably over 1500 bars.

3. A method according to claim 1 or claim 2 characterised in that the volume of the antechamber (1) at the opening of the shut-off means (2) is at least twice as great as the volume which is downstream of the shut-off means (2) and which includes the mould cavity (3).

4. A method according to one of claims 1 to 3 characterised in that the volume of the antechamber (1) is kept constant during the injection operation so that the total pressure in the mould cavity (3) is produced by expansion of the plastic material which initially fills only the antechamber (1).

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
18. Januar 2001 (18.01.2001)

PCT

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7. Juli 2000 (07.07.2000)

(25) Einreichungssprache: Deutsch

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(30) Angaben zur Priorität:
99113324.0 9. Juli 1999 (09.07.1999) EP

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(81) Bestimmungsstaaten *(national)*: CA, US.

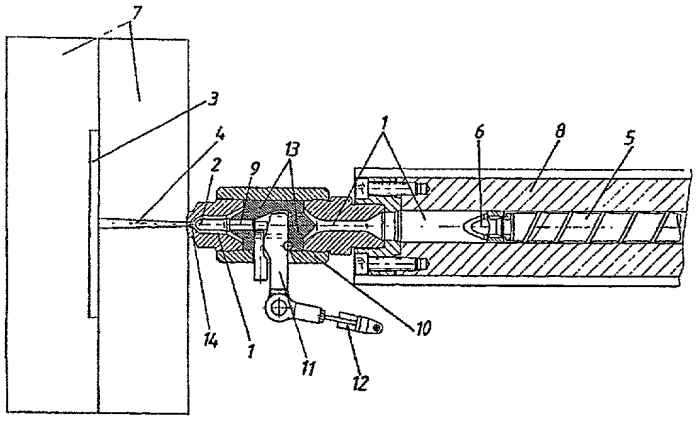
(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Veröffentlicht:
— *Mit internationalem Recherchenbericht.*

Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(54) Title: INJECTION-MOULDING METHOD

(54) Bezeichnung: VERFAHREN ZUM SPRITZGIESSEN



(57) **Abstract:** The invention relates to an injection-moulding method, in which pressurised synthetic material is injected from a sealable antechamber (1), after the removal of a seal (2), into a moulding cavity (3), filling the latter under pressure. The volume of the antechamber (1) and the pressure which prevails therein when the seal (2) is removed, have values which result in the formation of at least half the pressure achieved during the moulding process in the moulding cavity (3), if the antechamber (1) volume is maintained at a constant level throughout the injection-moulding process.

(57) **Zusammenfassung:** Verfahren zum Spritzgiessen, bei dem unter Druck stehender Kunststoff aus einem absperrbaren Vorraum (1) nach Öffnen einer Absperrung (2) in einen Formhohlraum (3) gespritzt wird und diesen unter Druck füllt, wobei das Volumen des Vorraums (1) und der darin herrschende Druck beim Öffnen der Absperrung (2) Werte aufweisen, bei deren Vorhandensein mindestens die Hälfte des im Verfahren im Formhohlraum (3) erreichten Druckes auch entsteht, wenn das Volumen des Vorraumes (1) während des Einspritzvorganges konstant gehalten wird.

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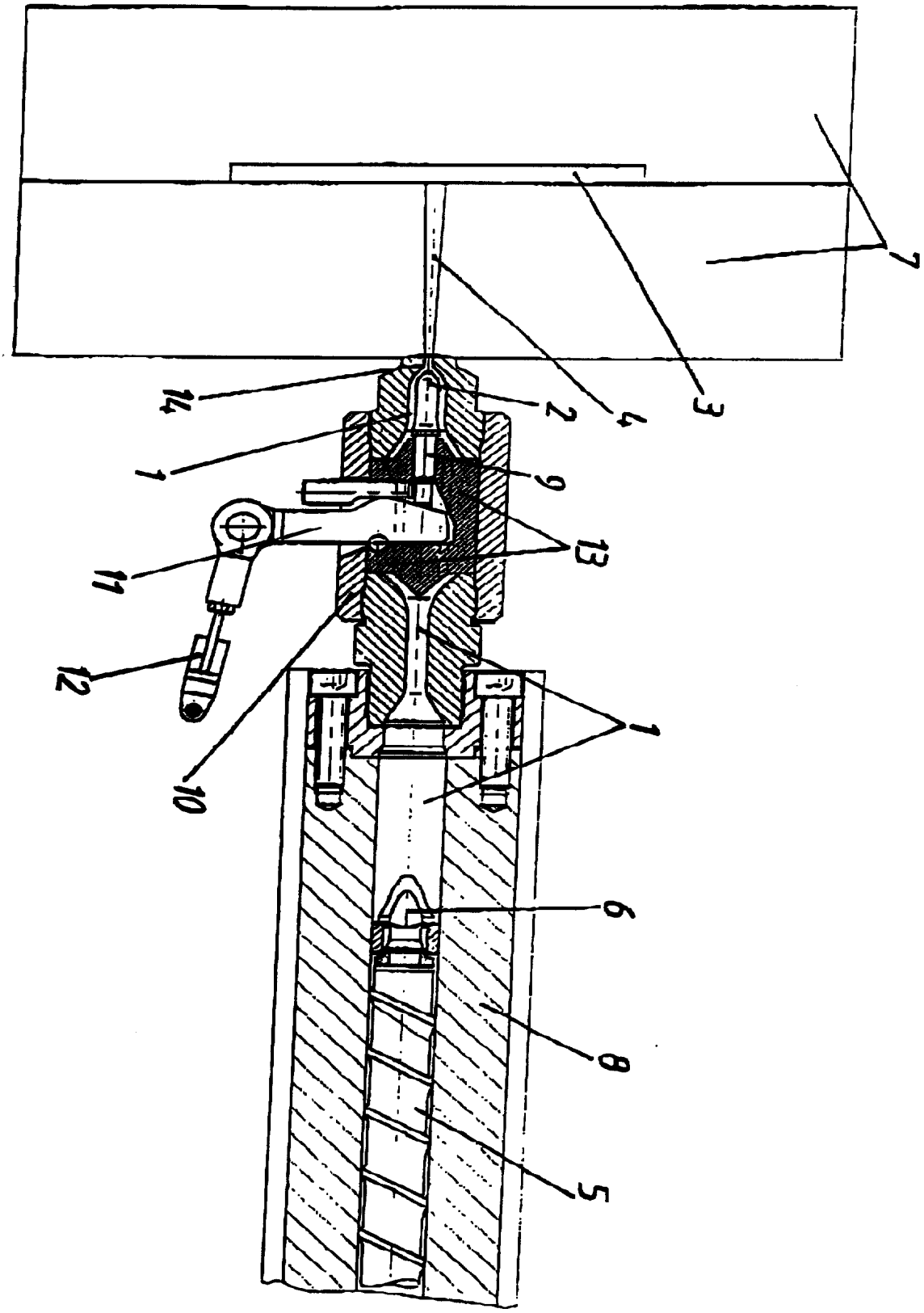

Atty. Docket No.: H55-054 US

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

INJECTION-MOLDING METHOD

the specification of which (check one):

[✓] is attached hereto

[ ] was filed on _____ as Application Serial No. _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Applications			Priority Claimed	
99113324.0 (Number)	Europe (Country)	9 July, 1999 (Day/Month/Year Filed)	Yes [X]	No [ ]
PCT/AT00/00186 (Number)	Austria (Country)	7 July, 2000 (Day/Month/Year Filed)	Yes [X]	No [ ]

I hereby claim the benefits under Title 35, United States Code, §119(e) of the following United States Provisional Application:

		Priority Claimed	
(Number)	(Day/Month/Year Filed)	Yes [ ]	No [ ]

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below, and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as

defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

This application is a _____ of U.S. Application

Serial No.	Filing Date	Status (Patented, Pending, Abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connect ed therewith.

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